Pediatric Emergency Care in Disaster-Affected Areas: A Firsthand Perspective after Typhoons Bopha and Haiyan in the Philippines

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Abstract

Disasters are defined as man-made or natural causes that disrupt a population and cause widespread human, material, economic, or environmental losses, exceeding that population's capacity to cope using its own resources. This review highlights the epidemiology and disease patterns in disasters, with specific application to the care of children in the austere environments created in the aftermath of disasters. The review also attempts to describe the experience from a firsthand field hospital perspective of a multinational team in caring for patients in the aftermath of two natural disasters in the Philippines, during both Typhoon Bopha and Typhoon Haiyan. In doing so, we will place these experiences in the context of the current literature on the subject of pediatric management during disaster emergencies and describe lessons learned to refine team approaches and patient care methodologies. The review also discusses methods for improvement in emergency preparedness for disasters, with specific mention of the roles of telemedicine and just-in-time simulation training, when feasible. Lastly, it will review the importance of community and military collaboration and planning for aftercare post-departure of foreign medical teams.

Keywords
- pediatric disaster management
- austere environment
- just-in-time training
- typhoon
- Philippines
- Typhoon Bopha
- Typhoon Haiyan
- pediatric triage tools
- disaster management team

Introduction

Epidemiology of Disasters

Disasters are defined as man-made or natural causes that disrupt a population and cause widespread human, material, economic, or environmental losses, exceeding that population's capacity to cope using its own resources.[1] Data from International Federation of Red Cross and Red Crescent Societies (IFRC) and the Center for Research on Epidemiology of Disasters demonstrate an increase in frequency of disasters over the past 50 years, with almost 2 billion people affected by disasters in the past 10 years alone.[2,3] Approximately 90% of disaster-related injuries and deaths occur in limited resource areas of low and middle income countries (LMICs), that is, countries with per capita income levels below US$760 per year, where local populations have less capacity to cope and even less capacity to plan and prepare.[4] In these countries, children are particularly vulnerable, subjected to high rates of malnutrition and susceptibility to communicable diseases, psychological frailty, and risk for disrupted family environments. By some estimates, close to 200 million

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children per year are affected by disasters, and 50% of victims in man-made and natural disasters are children.[5,6] Pediatric patients have specific needs that require additional care and special considerations.

Disasters in the Asia-Pacific Region

There were 127 major natural disasters reported in the Western Pacific region in the decade 1990 to 2000, constituting 23% of the total 561 natural disasters worldwide. The most disaster-prone countries during this time period in the region were the Philippines, China, and Vietnam.[7] More recently in 2014, the World Risk Index (a tool to assess and estimate the disaster risk of a country based on both external and internal factors) ranked the Philippines second out of 171 countries.[8]

On November 8, 2013, Typhoon Haiyan (referred to locally as Yolanda) made landfall in the Philippines, causing over 6,300 deaths and affecting over 16 million Filipinos.[9] It was designated by the World Health Organization (WHO) as a category 3 disaster (the highest category level) and was one of the most powerful storms ever recorded worldwide. The storm impacted the Philippines less than 1 year after Typhoon Bopha (referred to locally as Pablo), the strongest tropical cyclone ever to hit the southern Philippine island of Mindanao, struck in early December 2012. The death toll from Bopha reached over 1,000 people, with residual damage from floods and landslides.[10]

This review attempts to describe the experience from a firsthand field hospital perspective of a multinational team composed of volunteers (both Filipino and foreign) from a nongovernmental organization (NGO) in caring for patients, during both the Typhoon Bopha and Haiyan disasters. In doing so, we will place these experiences in the context of the current literature on the subject of pediatric management during disaster emergencies and describe lessons learned during Typhoon Bopha by this team that were subsequently used to refine team approaches and patient care methodologies during Typhoon Haiyan.

Team Description and Functionality

Team Composition

A foreign medical team (FMT) is defined by the WHO "Classification and Minimum Standards for Foreign Medical Teams in Sudden Onset Disasters" as a group of health professionals and supporting staff outside their country of origin, aiming to provide health care specifically to disaster-affected populations. This can include governmental (both civilian and military) and NGO teams.[11] By definition, an FMT has staff to provide basic and/or advanced health care based on international classification levels and minimum standards during a limited time period in existing or temporary structures, with or without field hospitals.[11]

Our team was unique in that it was a collaboration between individuals from several countries as well as local Filipinos, all of whom were volunteers for an NGO (Operation Smile International or OSI). The team worked hand-in-hand with other on-site organizations, including the Red Cross Philippines and the Eastern Mindanao Command of the Armed Forces of the Philippines. By WHO standards, the OSI team responding to Typhoon Bopha in 2012 met the criteria as an FMT Type 1, that is, ability to provide outpatient initial emergency care of injuries and other significant health care needs.[11] As one of the lessons learned from the epidemiology of patients encountered during that experience in 2012, the team responding to Typhoon Haiyan in the subsequent year 2013 was staffed differently to include members that constituted an FMT Type 2, that is, a team with ability to handle inpatient acute care, general and obstetric surgery for trauma and other major conditions, and some cases of more complex inpatient referral surgical care, including a limited intensive care capacity.[11] This was, however, in the latter instance, in collaboration with a local district hospital, much of which had been structurally destroyed in the typhoon, but which remained semi-functional. The team responding to Typhoon Haiyan in 2013 was composed of 2 pediatric intensivists, 1 adult critical care specialist/pulmonologist, 3 surgeons (general and plastics), 1 orthopedic surgeon, 2 anesthesiologists, 1 internal medicine specialist, 1 obstetrician/gynecologist, 1 psychiatrist, 2 dentists, 10 nurses, 1 engineer, 4 medical students, and 3 logistics coordinators. This team was therefore clinically capable of seeing a wider spectrum of both inpatients and outpatients.

Typhoon Bopha Response Team

During the Bopha Response in 2012, the OSI team was deployed to Baganga, Davao Oriental, Mindanao 10 days after the typhoon made landfall. The team was situated in a tent field hospital setting in the community that was capable of providing both medical and surgical outpatient and basic inpatient care. The tent field hospital was staffed by the OSI team 24 hours a day for 2 weeks, in collaboration with Red Cross Philippines. This was a remote location in an area without a local district hospital. The nearest hospital was 4 hours away by road, which was difficult to traverse due to local conditions of a broken bridge over the waterway, necessitating transport by both land and water to the nearest large cities, as air transport was usually not available. This made transfer of our critically ill patients (traumatic brain injury, status asthmaticus, obstetric emergencies, cerebrovascular accidents) by land very challenging, but also made access to care at the field hospital difficult for local patients. The team therefore deployed a subset of primary care providers to outlying barangay neighborhoods in Poblacion, Binondo, and Lambajon to bring clinician providers to the areas most requiring basic medical care. This model worked well to meet the local health care needs of the population, both adult and pediatric, who were the "walking wounded" or in need of primary care/chronic care services in outlying communities.

Typhoon Haiyan Response Team

In 2013 the OSI team was deployed after Typhoon Haiyan to Ormoc, Leyte, Philippines, approximately 4 weeks after the initial landfall of the typhoon. The delayed response was by request of the local government to supplement the district hospital's ability to provide specialty care services in the weeks following the disaster and to provide much needed respite for local hospital–based health care providers. Following lessons learned from

2012, the team adopted a similar model, wherein the main specialty care team was based at the Ormoc District Hospital or ODH (supplemented by tent facilities), with a subset of primary care specialists and nurses deployed on a daily basis to the outlying barangay neighborhoods of Quezon Junior, Caas, Lake Danao, Cabantian, Liberty, Patag, and Camansi. These field clinics were subsequently able to triage and transport patients who required higher level of care and refer them to OSI specialty team members based at the hospital, in cooperation with military officials for transport, as elaborated upon later.

Epidemiology of Patients and Disease Patterns

During the Bopha Response, the team cared for a total of 1,178 patients in the field hospital as well as in outpatient visits to the field clinics in the barangay neighborhoods of Lambajon, Poblacion, and Binondo, 27% of whom were children younger than 5 years. The most common diagnoses/chief complaints seen and treated in the pediatric population were acute respiratory infections, fever, and open wounds and bruises (see ►**Table 1**).

During the Haiyan Response, the team cared for a total of 1,404 patients both at ODH and in the field clinics, 26% of

Table 1 Chief complaints by age presenting to our field clinics in Baganga, Philippines, after Typhoon Bopha (Pablo) in 2012

Disease/syndrome/health event	<5 years old	>5 years old	
	Cases	Cases	
Fever	48	94	
Cough, colds, sore throat with or without fever	144	330	
Fever with rash	0	1	
Fever with spontaneous bleeding (i.e., nose bleeding, gum bleeding)	1	0	
Nosebleed without fever	0	1	
Fever with headache, muscle pains	0	5	
Yellow eyes or skin with or without fever	1	0	
Fever with other symptoms not listed above	19	39	
Loose stools with or without dehydration	34	31	
Loose stools with visible blood	1	2	
Open wounds and bruises/burns	21	84	
Fractures	0	2	
Skin disease	7	1	
Toothache or dental issue	0	16	
Eye itchiness, redness, with or without discharge	0	2	
Loss of appetite	0	1	
High blood pressure	0	15	
Known diabetes	0	1	
Difficulty in breathing and wheezing	2	3	
Paralysis of the limbs	0	2	
Visible wasting with or without bipedal pitting edema	0	2	
Abdominal pain	4	41	
Back pain/body pain	0	85	
Chest pain	0	19	
Headache	0	58	
Scrotal enlargement	0	1	
Labor pains/pregnancy consult	0	2	
Soft tissue mass or abscess	2	4	
Eye pain	0	1	
Malnutrition/vitamin deficiency	33	3	
Hernia	0	1	
Dizziness	0	10	
Trauma (vehicular crash, fall)	0	4	
Total	317	861	1,178

whom were younger than 5 years. There were 14 patients who underwent specialty surgical procedures and 5 patients who were cared for in the makeshift intensive care unit (ICU) at ODH staffed by 1 adult intensivist and 1 pediatric intensivist from OSI (the hospital did not have a preexisting ICU facility). The major diagnoses seen in the pediatric population were acute respiratory infections, diarrhea with and without dehydration, and skin diseases (see ►**Table 2**). There was one mortality at the hospital during care by the team. The patient was a 15-year-old with blunt abdominal trauma who died from postoperative septic shock progressing to pulseless electrical activity arrest that was refractory to conventional pediatric resuscitation measures. There were two patients who required invasive ventilation, one of whom (an adult with congestive heart failure and thyrotoxicosis) was able to be extubated and the other (a 6-month-old with respiratory failure due to pneumonia and bilateral pneumothoraces) was ultimately transported by military air flight to a specialty pediatric care hospital in Manila after stabilization by the OSI team. The air transport of this infant was possible due to a collaborative effort between our team's pediatric intensivists, anesthesiologists, nurses, and the Philippine Air Force. Prior to transport, the 6-month-old was ventilated using our team's pediatric LapTop ventilator (LTV) although, due to a power surge, this became nonfunctional after 12 hours and the patient required shift-based manual ventilation (hand-bagging) for 48 hours prior to transport. She was subsequently extubated several weeks later in Manila after a protracted course in the pediatric ICU there. In addition, there was an adult patient who had suffered a myocardial infarction and required inotropic support as well as an adolescent who had congestive heart failure secondary to postpartum cardiomyopathy. We were able to care for this young woman and her newborn together in the makeshift ICU.

In addition to provision of medical care, the teams also utilized logistics volunteers and student volunteers to distribute food packages and water to affected populations during both typhoon response missions. Several authors note in the literature that, although the medical needs of the affected population may be great, the lack of nonmedical necessities is usually the most immediate threat to life. While resuscitation and medical care are glamorous, they are not the only life-saving activities in the postdisaster environment. These can include sanitation programs, water distribution, building of shelters, and food distribution, activities in which the OSI team participated.[12]

Disaster Management for the Pediatric Population

Injury Patterns Postdisaster

Different disasters produce different types of injury patterns. An understanding of disaster epidemiology is necessary to help estimate likely injury patterns and timelines of response to properly anticipate and prepare for the needs of the affected population.[13] In general, a triphasic distribution of medical issues can be seen after a sudden-onset disaster.[14] The initial phase, within minutes of the disaster onset, is characterized by high mortality due to injuries incompatible with life. In the second phase (subsequent hours after disaster onset), medical care is focused on early trauma management.[14] The main problems encountered are adequate first aid and evacuation, which have to be performed immediately, usually by locals, since foreign aid and outside assistance are

Table 2 Chief complaints by age presenting to our field clinics in Leyte, Philippines, after Typhoon Haiyan (Yolanda) in 2013

Disease/syndrome/health event	<5 years old	>5 years old	
	Cases	Cases	
Fever	9	15	
Cough, colds, sore throat with or without fever	270	560	
Dental issue	0	29	
Loose stools, with or without dehydration	5	4	
Open wounds and bruises/burns	3	17	
Fractures	1	1	
Skin disease	30	45	
Animal bites	0	2	
High blood pressure	0	53	
Known diabetes	0	36	
Abdominal pain	40	110	
Back pain/body pain	0	87	
Headache	0	66	
Scrotal enlargement	1	20	
Total	359	1045	1,404

often not on site soon enough to deal with the acutely injured victims.[12,15] In the third phase, occurring days to weeks after the disaster, major efforts are needed to prevent and treat complications such as sepsis, multiple organ failure, and psychological problems as well as the large number of displaced persons and lack of essential resources such as safe water, food, energy, and shelter.[14] Initial waves of injured patients are soon followed by patients with medical problems typical for the local region, exacerbated by delays to care and further fragmented health care systems.[15] The OSI team response dealt predominantly with the third phase in both typhoon disaster responses, and the epidemiology of patient chief complaints was consistent with that seen in the literature. Due to the anticipated needs of the community, the team brought appropriate personnel and resources, including a psychiatrist, to help address posttraumatic stress and mental health issues in the affected communities.

During the postdisaster phase, trauma issues are usually related to recovery and clean-up operations or delayed medical attention due to inaccessibility. More commonly, long-term health issues, daily urgent medical needs, mental health and stress, environmental and infectious disease concerns, public health issues, and special needs populations form the bulk of medical issues. Primary care for all age patients needs to be addressed as soon as 24 to 48 hours after the disaster.[15] In addition to responding to immediate needs (usually traumatic injuries) specific to a given disaster, providers of pediatric care must address major causes of pediatric morbidity and mortality, which include diarrheal diseases, acute respiratory tract infections, measles, malaria, severe bacterial infections, malnutrition and micronutrient deficiencies, injuries, burns, and poisoning.[16] Neonates born during disasters require attention and their needs are easily ignored or underappreciated in the midst of a crisis.[17] Professional organizations and consensus statements have recommended that, when possible, pediatric emergency and critical care resources be regionalized so that resuscitation and stabilization are available close to every community; common low-risk conditions are treated at community (district) hospitals, and high-risk complex conditions are transferred to pediatric hospitals.[18] However, in limited resource settings and developing countries, this is often not feasible and a dedicated pediatric hospital often does not exist.

In all phases postdisasters, local medical facilities are often disrupted and require international help, not only in dealing with the disaster, but also to maintain routine health facilities for unrelated conditions. Gnauck et al describe a retrospective cohort review of all patients presenting to a disaster medical assistance team (DMAT) during four different natural disasters.[19] Of the 2,196 patients encountered, almost 30% were pediatric patients. In that study, pediatric patients were more likely to present with chief complaints of upper respiratory infections or wounds, less likely to present with musculoskeletal pain or abdominal pain, and equally likely as adults to present with rashes. They also noted that children were more likely to be given pain medication and antibiotics than adults and less likely than adults to require tetanus prophylaxis after wounds and injuries (due to prior immunization in the school-age population). They concluded that pediatric-specific severity category criteria, treatment guidelines, equipment/medical stocks, and provider training are warranted for DMAT response preparations.[19] These findings are consistent with the patient demographic and epidemiology seen by our team during both Typhoon Bopha and Typhoon Haiyan as well as those within other reports.[20–22] Given the large percentage of pediatric patients seen in this study and in our team's experiences, the need for specific pediatric preparedness is reinforced.

Because external (nonlocal) emergency responders are often poorly versed in care of tropical and, to the resource-rich provider's eyes, "atypical" diseases, coordination with local health care providers and ministries of health is essential, albeit sometimes difficult, owing to disruptions inherent to disaster environments.[23] This was found to be an effective model for our teams in the Philippines, where external providers worked closely hand-in-hand with local Filipino pediatricians and primary care providers to administer care, particularly to patients with diseases such as leptospirosis, dengue fever, and tetanus, the management of which external providers were less familiar with. This cooperative team approach also allowed for better integration of local culture and language during patient care, preventing consumption of spare resources and manpower and preventing some of the problems seen with exclusively foreign medical teams in other disaster situations reported in the literature.[24,25]

Pediatric Triage Tools in Disasters

There have been studies in the literature comparing various triage algorithms for pediatric patients during mass casualty incidents and disasters. The only triage tool that has been designed specifically for pediatric patients is the JumpSTART tool[26] (see ►**Fig. 1**). The goal of this tool in disaster settings is to avoid siphoning of resources from patients who need them and to avoid undertriage by recognizing some key differences between adult and pediatric physiology and using appropriate pediatric physiologic parameters at decision points. The Sacco triage method (STM) is an evidence-based triage and resource management system that maximizes expected survivors in consideration of the timing, availability, and capability of transport and treatment resources.[27] Pediatric patients were taken into consideration in the design of the STM.

Preparedness for Pediatric Emergency Care after Disasters

Just-in-Time Training and Role of Simulation

Nonpediatric hospitals in a disaster scenario must identify staff with pediatric capability, organize contact information, and develop job assignments for them. All members of the hospital team who will provide care to children will benefit from drills and education as well as from just-in-time education tailored to the circumstances of the emergency.[28] Internet resources may be invaluable to support just-in-time education, but electronic access may be unreliable during emergencies, so consideration should be given for printed educational resources.

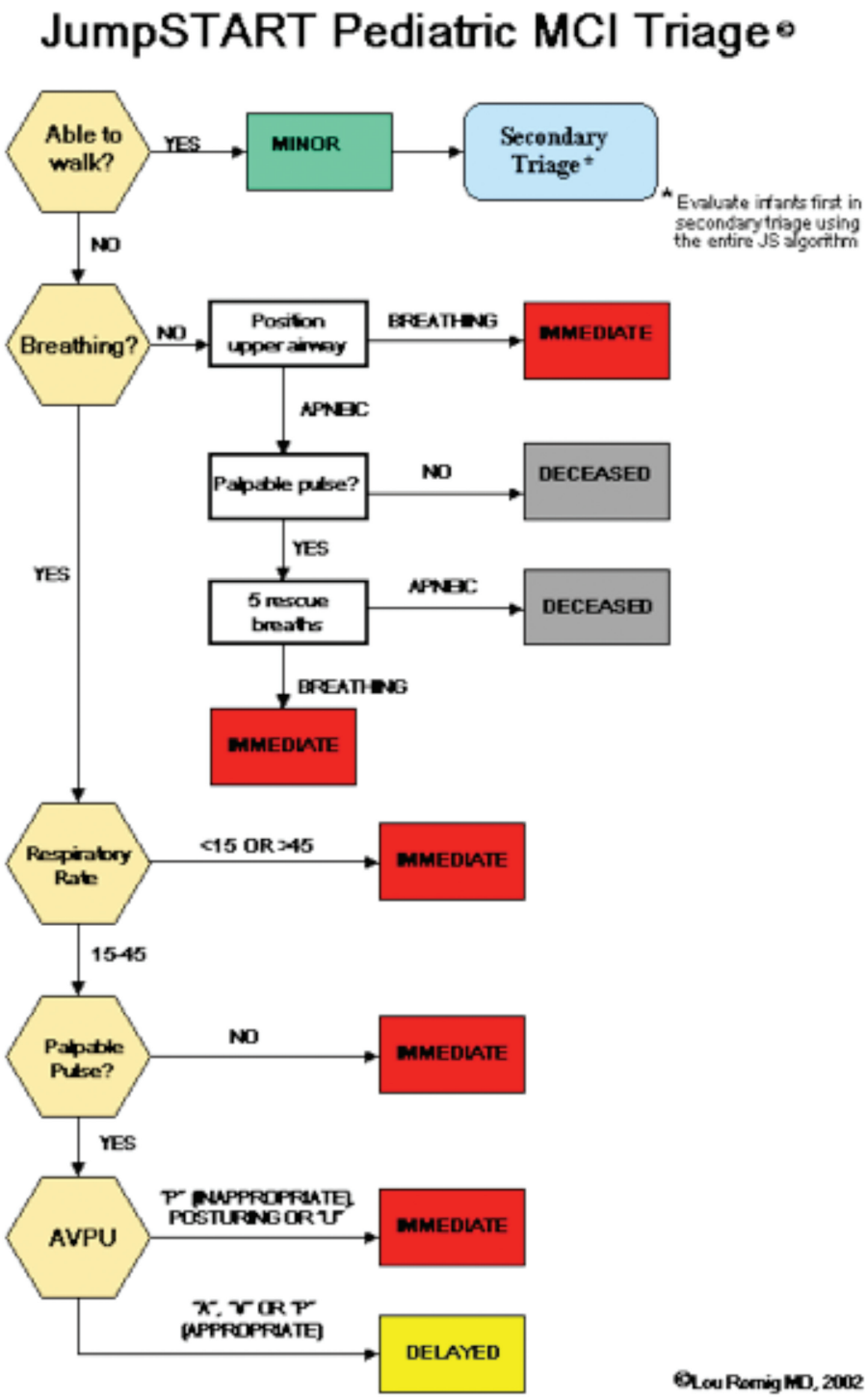

Fig. 1 The JumpSTART triage algorithm for use in pediatric patients during mass casualty incident (MCI) disaster management (Reprinted with permission of Dr. Lou Romig.)

Interhospital transport resources may also be limited in pandemics and disasters. Decision makers must evaluate the merits of sending critical care staff, supplies, and equipment from uninvolved remote sites to a localized disaster versus transporting the patients from nonpediatric hospitals to a pediatric center or tertiary care hospital, when available. Priorities must be determined for those who should be transferred first (one-on-one transport staffing for the most severely ill patients may exhaust limited critical care resources). In a disaster or pandemic, optimizing population outcomes may require transport strategies distinct from those used in ordinary circumstances, adapting to event-specific local needs and resources.[28] Supplies and medications unique to pediatric populations may be rapidly depleted in a large disaster, and the regions' hospitals should have knowledge and access to these resources at other sites. The levels of supplies should ideally be monitored to assess surge capacity.

Role of Telemedicine for Pediatric Consultation

When feasible, pediatric consultants should be available to all regional partners by phone or telemedicine for remote consultation. Potential benefits of telemedicine communications include improved situational awareness, assistance in field triage, and timely expert consultation.[29] However, in limited resource settings and LMICs, telemedicine communication capability may not be feasible and/or may be vulnerable to damage in some disaster environments.[29]

Interface of Pediatric Care with Emergency Obstetric Care

Medical relief efforts in the past have highlighted the needs of pregnant, laboring, and lactating mothers in all phases of a natural or man-made disaster. Like other vulnerable populations, they face increased risks during disaster periods. Studies have correlated disaster with increases in preterm delivery, spontaneous abortions, and low-birth-weight infants, so it is easy to see how the quality of obstetric care will have a direct impact on neonatal outcomes within the pediatric population.[30] Additionally, disaster periods can quickly escalate the degree of morbidity; a healthy pregnant woman who sustains abdominal trauma has risks of suffering placental abruption, intrauterine fetal demise, and maternal hemorrhage with possible coagulopathy. In emergency response efforts, the obstetrician can be required to provide a higher level of care with less support. Furthermore, the obstetrician's skill set has to be transferred effectively to a less structured setting. Flexible physical examination skills such as auscultating fetal heart rate with a stethoscope and palpating for uterine contractions while standing by a noisy road or other hostile environments can be challenging. Circumstances may dictate a change in the usual standard of care. This may also raise liability concerns.[31]

Medical personnel involved in disaster response need to know where pregnant women are being cared for, what personnel are attending their delivery, if birthing kits are readily available, and if couplet care is feasible. Like other specialists, volunteer obstetricians must integrate with the local team in an effective manner and quickly "foster functional working relationships with local and regional critical care clinicians."[31,32] Traditional hierarchies may not always be in place and it is important to resist the urge to recreate them and instead remain focused on optimizing patient outcomes. The nurse midwife from a local relief group may be more helpful in assisting laboring mothers while the obstetrician from a different team performs postpartum rounds. The goal in these austere settings should not be to modify or improve the local practices, but rather to adjust to the limited resources and provide the best possible care for the patients within the local environment and infrastructure limitations after a disaster. During our team's relief efforts after Typhoon Haiyan, a patient with peripartum cardiomyopathy was identified in this fashion and relocated to a higher acuity ward as described earlier.

The Centers for Disease Control and Prevention (CDC) provides a good summary of key evaluations that pregnant women require. This cursory list can serve as a guide for any nonobstetrical or nonspecialist clinician providing emergency care in the setting of an obstetrical patient surge postdisaster.[33]

Professionalization of the Disaster Response

Mobilization of Community Resources: Challenges and Lessons Learned

As discussed earlier, the deployment of both OSI teams was in the third phase of the disaster relief effort. Both teams were self-sufficient in terms of equipment, consumable supplies, portable ventilator, sterilizing equipment (such as autoclaves for surgical equipment), tents, personal necessities, food, and water. Backup electrical generator sets were also brought by the team, given that power outages were frequent in the postdisaster phase. Mission supplies for the community group included water purifiers, wound care supplies, splints, tetanus toxoid, antibiotics, and analgesics to meet the needs of the local community. Medical supply lists were based on what was reported in the literature to be typical primary patient needs after floods and hurricanes, anticipating the need for supplies to treat fractures, burns, and both acute and neglected wounds.[34,35]

Safe accommodation for medical teams in the postdisaster period is always a consideration for FMTs. After Typhoon Bopha in the Philippines, there were few houses that were left standing in the region where our team was functioning, and so many team members slept in tents or hammocks within the compound of one of the few remaining local housing structures (when not "on call" at the hospital). This mission base also became a stockroom for medical inventory, with a backup generator running continuously to provide refrigeration/cold chain preservation for tetanus toxoid vaccine. Our team imported its own food and water for the entire duration of the stay, so as not to burden the already taxed limited resources of the disaster site, as advised in prior publications.[36]

Prior to the deployment of the entire team, an advance team was sent to the area to perform a basic needs assessment that would inform supply acquisition and team composition. The advance team gathered mitigating medical information critical to the issues and needs of the community, while simultaneously providing basic primary care services. Data were gathered from key informants to ultimately provide services that integrated with the needs of the local community.

Alleviation of the Filipino Health Care Workforce by Foreign Medical Team

The role of the OSI hospital disaster assistance team was to help restore routine medical and surgical facilities overwhelmed by the disaster, and support specialist elective services. Team members had to be flexible, willing to deal with ambiguity, and have an ability to innovate, all necessary qualities of FMT volunteers described in prior literature.[36]

During Typhoon Haiyan, the Department of Health of the Philippines reported that on November 19, 2013, there were 22 FMTs deployed to affected areas, composed of 546 medical staff. Sixteen of the field hospitals established were type 1,

while five were type 2. Ten additional FMTs composed of 213 staff were deployed after November 19.[37] All FMTs were required to be self-sufficient (food, water, and fuel) for the duration of their stay, as resources were quite limited. Provision of fuel was a major challenge. Patients needing critical care were airlifted to various specialty hospitals in the country. In Cebu, the capital of the affected region, FMTs and national medical teams provided temporary medical services, but additional resources were needed to provide health care for the migrant population in other cities. The first wave of FMTs began to phase out by early December 2013 as local hospitals began to recover from the disaster.[37]

Collaboration and Coordination with Regional Health Authorities and Civil-Military Engagement

As mentioned repeatedly, integration with existing services is an essential component of the goal of disaster medicine. It is critical to work closely with local government, organizations, and other sectors, including civil-military coordination.[36,38] All agencies involved in relief and development activities share a responsibility to include local populations in all phases of projects from design through to delivery and evaluation. This inclusive process also helps to establish a learning process that enhances capacity building, empowering local communities to regain control and promoting continuity in aftercare coordination, as elaborated upon later.

Coordination with the Eastern Mindanao Command of the Armed Forces of the Philippines, the Philippine Air force, and the local health care units served as the means by which our DMATs were able to reach, triage, and provide health care services to patients located in isolated, safety-compromised sites that were inaccessible to many other relief agencies. These organizations provided security, transport, and logistic assistance to our on-the-ground mobile teams during both disaster responses, and were instrumental in air transport of critically ill patients out of the region to specialty facilities, when available. Security measures also included curfews enforced by the Armed Forces, which is consistent with recommendations in the literature regarding security concerns after disasters.[35]

Aftercare Coordination: Follow-up Education, Rebuilding, and Logistical Support for Hospitals Impacted by Disaster

Plans for transition of care postdisaster are critically important. Local governments and NGOs need to consider what happens when external providers leave, what occurs when donated resources fade away, who is responsible for long-term care of patients operated on during an emergency, and who will care for patients newly burdened with posttraumatic stress disorder and exacerbations of preexisting conditions, among many other complex issues.[23] FMTs and DMATs must consider that there are significant ethical implications of providing care for limited time periods and then creating a "departure vacuum" for follow-up care in a region or community. These are difficult issues with complex answers and limited solutions.

Some of the aftercare plans put in place by our teams included coordination of American Heart Association (AHA) Basic Life Support (BLS) and Pediatric Advanced Life Support (PALS) training by members of our OSI team who were certified instructors for these courses. The training took place at ODH several months after the disaster for nursing and physician clinical providers, once order was re-established at the hospital. This was felt to be a primary educational need by both the local hospital providers and our team members as a result of patient care encounters experienced during collaborative care efforts in the post-disaster phase. The training was designed as a train-the-trainer cascade model to establish local instructors in the region to promote sustainability of the training and educational goals. Fundraising for these postdisaster educational efforts was promoted through social media and donations solicited through collaborating NGOs. Funds that were obtained in this manner were also used to donate resuscitation equipment to ODH, including cardiorespiratory monitoring equipment and a portable automated external defibrillator with adaptive pediatric capabilities, which the hospital did not previously own.

Conclusion

Care of the pediatric patient can be challenging in any limited resource setting or austere environment during the best of times due to the high cognitive load required for care of this population. However, additional challenges occur in the post-disaster setting. DMATs can provide much-needed help during these events, but can only do so effectively and responsibly with proper advance planning to ensure self-sufficiency, adequate preparation for anticipated care needs, collaboration with local providers, and appropriate aftercare transitions when the team departs. In this manner, teams can provide the best care in both the short and the long term for patient populations impacted by disasters.

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